

Isotope data strengthens suspicions of ivory stockpile theft

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Tusks with CITES markings in a recent ivory seizure from Uganda. Credit: John E. Brown III

In January 2019, a seizure of 3.3 tons of ivory in Uganda turned up something surprising: markings on some of the tusks suggested that they

may have been taken from a stockpile of ivory kept, it was thought, strictly under lock and key by the government of Burundi.

A new study from University of Utah distinguished professor Thure Cerling and colleagues, published in *Proceedings of the National Academy of Sciences*, uses carbon isotope science to show that the marked tusks were more than 30 years old and somehow had found their way from the guarded government stockpile into the hands of illegal [ivory](#) traders. The results suggest that governments that maintain ivory stockpiles may want to take a closer look at their inventory.

Ivory's isotope signatures

Cerling is a pioneer in the use of isotopes to answer questions about physical and biological processes. Isotopes of a given element refer to atoms of the element that vary in their number of neutrons, and thus vary oh-so-slightly in mass. A carbon-14 isotope has one more neutron than carbon-13, for example.

Some isotopes are stable and some are unstable. Unstable isotopes decay into other isotopes or elements through [radioactive decay](#). Since the rate of decay is known for unstable isotopes, we can use the amounts present in a sample to determine ages. That's how carbon dating works—it uses the rate of decay of unstable carbon-14 to determine the age of organic matter.

Around a decade ago, Cerling attended a presentation at the U by Sam Wasser of the University of Washington, who was studying the genetics of wildlife and using those tools to investigate the date and place of wildlife poaching. Cerling, recognizing that his expertise in isotope science might be able to add useful information, began an ongoing collaboration with Wasser.

In 2016, Cerling, Wasser and colleagues published [a study](#) that addressed a key question in the [ivory trade](#): how old is the ivory seized by governments? Some traders have claimed their ivory is old, taken before 1976, and thus exempt from sales bans. And with the average size of ivory seizures more than 2.5 tons, researchers, governments and conservationists wonder how much of the ivory is recent and how much is coming from criminal stockpiles—or is stolen from one of several ivory stockpiles held by the governments of some countries in Africa.

"Governments keep their stockpiles for multiple reasons," Wasser says. "They hope to sell the ivory for revenue, sometimes to support conservation efforts. However, they can only sell ivory from elephants that died of natural causes or were culled because they were problem animals. They can't sell seized ivory because they don't know it came from the country."

With the combination of Cerling's isotope data and Wasser's genetic data, the [2016 study found](#) that more than 90% of seized ivory was from elephants that had been killed less than three years before. It was a sobering result, showing active and well-developed poaching and export networks. The study seemed to show that little ivory from government stockpiles had ended up on the black market.

Marked tusks

But the 2019 seizure of ivory in Uganda showed something concerning. Some of the tusks sported markings that looked suspiciously like the markings that CITES, the Convention on International Trade in Endangered Species of Wild Fauna and Flora, uses to inventory stockpiled ivory.

"Due to the markings seen on some samples of the ivory," Cerling says, "it was thought that quite a few samples in this shipment could be related

to material held in a government stockpile in Burundi. We were asked to date samples from this, and three other recent ivory seizures, to see if some samples could possibly be from older stockpiles."

To determine the ivory's age, the researchers collected small samples from the tusks and analyzed them for the amount of carbon-14 isotopes in each sample. They were looking specifically for the amount of "bomb carbon" in the tusks. Between 1945 and 1963, nuclear weapons testing doubled the amount of carbon-14 in the atmosphere, so anything living that's consumed carbon since then—including you—has a measurable carbon-14 signature. The amount of carbon-14 in a sample of ivory that hasn't yet radioactively decayed can tell scientists when the ivory stopped growing, or when the elephant died.

The method takes some calibration, using samples from organisms living in the same area. Some of the samples came from schoolchildren in Kenya, through a program called "Kids and Goats for Elephants." Because most families in rural Kenya keep goats the program, run by Cerling and Paula Kahumbu of WildlifeDirect engages children in collecting hair samples from goats for isotopic analysis. The isotope data is useful for many applications, including fighting elephant poaching and, in this case, calibrating the bomb carbon decay rate for more accurate dating of ivory.

A consequential result

The researchers analyzed ivory from four seizures in Angola, Hong Kong, Singapore and Uganda. Genetic data ensured that they weren't sampling two tusks from the same individual. The results of analysis from the Angola, Hong Kong and Singapore seizures were as expected—the samples were mostly around three years after the death of the elephant, with no tusks having been taken more than 10 years previous.

But the Uganda seizure, with the inventory markings on the tusks, showed something very different. Nine of the 11 tusks tested had been taken more than 30 years before, with the dates of death ranging between 1985 and 1988. Those dates are consistent with the age of ivory in the stockpile of the [government](#) of Burundi, which was inventoried and stored in sealed containers in 1989.

"My suspicions were affirmed," Wasser says. "The bigger surprise was how near to 1989 the elephants were killed." At the time Burundi assembled its stockpile, a condition of joining CITES, which assists governments in managing ivory reserves, was that the ivory to be stockpiled was old. The results suggest that that wasn't the case, Wasser says, which would have violated conditions for Burundi to join CITES.

"The hope is that CITES will request the stockpile to be re-inventoried," Wasser says, "including aging randomly selected tusks and secure the remaining stocks."

More information: Cerling, Thure E., 14-Carbon demonstrates that some illegal ivory is being taken from government stockpiles, *Proceedings of the National Academy of Sciences* (2022). [DOI: 10.1073/pnas.2211550119](#). doi.org/10.1073/pnas.2211550119

Provided by University of Utah

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